

Multidisciplinary Scientific and Engineering Approaches to Assessing Diesel Exhaust Toxicity

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Based on epidemiology reports, diesel exhaust (DE) containing particulate matter (PM) may play a role in increasing cardiopulmonary mortality and morbidity, such as lung infection and asthma symptoms. DE gas-phase components may modify the PM effects. DE components vary depending on several factors, including engine type and load as well as fuel type. With changing engine and fuel technology, DE composition is likely to change substantially, but it is unclear whether the toxicity will be altered. It has not been established which physiochemical properties of DE primarily induce the observed health effects. To assess the toxicity of DE generated with different engines and operated under varying conditions, toxicologists and engineers in two U.S. Environmental Protection Agency (U.S. EPA) laboratories have devised methodology to expose biological systems (cultured cells, rodents, and human volunteers) to either freshly generated DE or collected DE components. Additional collaborations with private organizations (e.g., the Advanced Collaborative Emissions Study project collaboration with academia, industry, and government headed by Health Effects Institute) and investigators at local universities (e.g., UNC at Chapel Hill) are also being used or will be used to assess toxicity. The findings to date show that the DE chemical composition can greatly affect the types and magnitudes of responses in the biological systems tested so far. Further testing will be aimed at identifying DE components responsible for the biological effects and aid assessment of the public health risk of DE. Strategies to decrease the emission of bioactive components (based on findings in these studies) through altered operating conditions can be used to improve health.

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